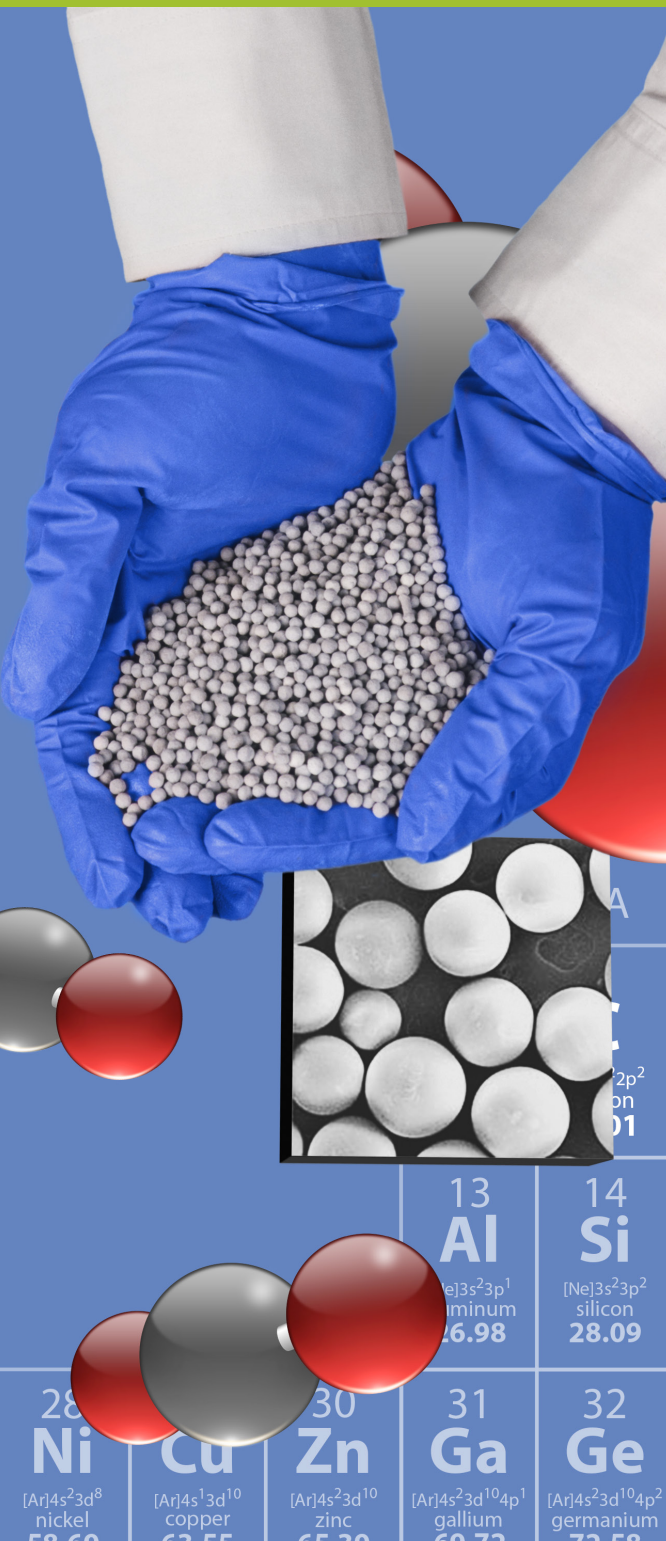


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Pelletized Basic Amine Sorbents Using Fly Ash and Polymer Binders



Opportunity:

Researchers at the U.S. Department of Energy's National Energy Technology Laboratory (NETL) have developed a method of basic immobilized amine sorbents (BIAS) pelletization which incorporates low cost additives (fly ash for added strength and a poly[chloroprene] [PC] binder) producing sorbent pellets displaying high carbon dioxide (CO_2) capture capacity, excellent cyclic stability under practical conditions, and superior attrition resistance in a dynamic environment. As such, these pellets represent a cost-effective, highly efficient technology for commercial-scale CO_2 capture. The technology

Overview:

Carbon sequestration is considered essential to significantly reducing CO_2 emissions. Basic immobilized amine sorbents (BIAS) have been demonstrated at bench and pilot-scales to be a highly promising means of post-combustion CO_2 removal. Wide-spread application of BIAS, however, will require pelletization to make these materials compatible with commercial reactors. Conventional methods of making BIAS pellets tend to result in pellets that lack mechanical strength, have reduced CO_2 binding capacity relative to the particle form of sorbent, and/or lose their ability to bind CO_2 after multiple adsorption-desorption cycles. Thus, there is a need for BIAS pelletization methods that are scalable, low-cost, and maintain sorbent CO_2 capture capacity and efficiency.

A BIAS pelletization method, involving extrusion of a wet paste into pellet shapes, well suited for semi-continuous scale-up has been developed. Pelletization is achieved via the novel combination of inexpensive, readily available fly ash (FA) as a strength additive and low-cost, hydrophobic poly(chloroprene) (PO) as a binder. The combination of FA strength additive and PC imparts both high strength and flexibility

(continued)



Principal Investigator:
Chris Wilfong

to the pellet, ideal for performance in a dynamic environment. The resulting BIAS/FNPC pellets possess high mechanical strength, attrition resistance, CO₂ capture capacity, and long-term CO₂ capture stability. The pelletization process is simple, lowcost, and scalable producing pelletized sorbents that can be used for packed beds, moving beds, and other reactor configurations. The pellets can also be used under both pressure and temperature swing conditions.

Significance:

NETL's pelletization technology:

- Provides an economical and scalable method for pelletization of amine-based sorbents
- Generates BIAS pellets possessing high mechanical strength and CO₂ capture capacity and efficiency
- Produces hydrophobic sorbent pellets for effective and cyclic CO₂ capture stability, even under practical humid conditions
- Yields sorbents with reduced energy demands, minimizing the overall cost of CO₂ capture.



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Applications:

CO₂ capture for coal and natural gas combustion plants, Marcellus shale gas cleanup, cement production plants, confined spaces such as submarines and space shuttled/stations, landfills and aerobic digesters for biogas cleanup, and waste incineration units.

Related Patents and Patent Applications:

- Provisional Patent Application (**S-140295**), titled "A Pelletized Basic Immobilized Amine Sorbent (BIAS) Utilizing Fly Ash and Polymer Binders" has been filed. Inventors: Walter Wilfong, McMahan Gray, and Yee Soong
- U.S. Nonprovisional Patent Application No. **15/156,773** filed May 17, 2016, titled "A Pelletized Immobilized Amine Sorbent for CO₂ Capture." Inventors: Walter Wilfong, McMahan Gray, Yee Soong, and Brian Kaild.
- U.S. Patent No. **8,834,822**, issued September 16, 2014, titled "Regenerable xmmobilized Aminosilane Sorbents for Carbon Dioxide Capture." Inventors: McMahan Gray, Christopher Jones, and Sunho Chai
- U.S. Patent NO. **8,500,854**, issued August 2013, titled "Regenerable Sorbent Technique for Capturing CO₂ Using Immobilized Amine Sorbents." Inventors: Henry Pennline, James Hoffman, McMahan Gray, Daniel Fauth, and Kevin Resnik